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the aurora varied between a height of two to four miles, but very frequently much lower, as described by Mr. Tayler. Indeed, it was very common to see the lower surface of nebulous clouds illuminated by polar light, thus showing its proximity to the earth. I remember Sir Edward Parry, when in a different latitude observing the aurora, saw a bright ray shoot suddenly down between him and the land, distant at that time only 3000 yards. I have frequently seen it nearly—that is to say, apparently—touching the tops of the pine-trees, situated on a slight elevation, about a mile and a half from my observatory. And I may take this opportunity of mentioning, for it will not be devoid of interest to some in this meeting connected with the old North-West Company, now the Hudson Bay Company, that as Mr. Clark, one of its officers, was passing over a portage of the river *Maligne*, the coruscations of the aurora were so low and vivid that the Canadian voyageurs threw from them their knives, axes, or whatever metallic things they were carrying, and actually fell with their faces to the earth. Lastly, I would remark, that many have thought—old travellers especially—that there was a noise caused by the aurora resembling the rustling of a flag in a strong breeze. We almost thought so too, I mean Franklin, Richardson, and myself, for a long time; but we discovered that it was simply the effect of severe cold after a comparatively warm day; that is to say, when the snow had been thawed during the day, and a cold of 30 to 42 degrees minus zero had succeeded at night. On those occasions we heard a hissing sound, and when the aurora was in rapid motion, it was natural to associate that motion with the sound. However, that was not the case. Nevertheless, the Indians and many of the old residents in the Hudson Bay Company's territories are of unanimous opinion that its motions are sometimes audible.

THE PRESIDENT.—Sir George Back has left very little more to be said respecting this remarkable phenomenon. I am happy, however, to see near me Admiral van Dockum, the Minister of Denmark, that power to which Greenland belongs; the country in which Mr. Tayler made his observations. It gives me pleasure to remind you that the Danish Captain Graah, a distinguished maritime explorer, has admirably described the phenomena of the aurora borealis in a work which has been translated into English at the expense of this Society.*

The second Paper read was—

2. *Discovery by Captain JOHN PALLISER, F.R.G.S., and Dr. HECTOR, of Practicable Passes through the Rocky Mountains within the British Possessions.*

Communicated by the Right Hon. Sir E. BULWER LYTTON, Bart., M.P.,
Her Majesty's Secretary of State for the Colonies.

CAPTAIN PALLISER's despatch is dated from Fort Edmonton, his winter quarters on the Saskatchewan river, and narrates the proceedings of himself and his party about the east flanks of the Rocky Mountains and the upper course and tributaries of that river during the previous summer.

The chief results before us lie in the discovery and mapping of the following numerous passes :—

* See Graah's *Greenland*. J. W. Parker, Strand, 1837.—ED.

Two from the S. branch of the Saskatchewan to the Kutanie river, viz., the Kananaski and Vermilion.

Two from the Kutanie river to the Columbia river, viz. the Lake and the Beaver Fork.

One between the S. and the N. branches of the Saskatchewan, viz. the Little Fork.

One from the S. branch of the Saskatchewan to the Columbia, viz. the Kicking Horse.

In addition to these, the Northern Kutanie Pass has been laid down, and found to be within British territory.

The most promising of all the routes, for the purpose of crossing the Rocky Mountains, appears to be that laid down by Dr. Hector. He followed the Bow River tributary up to the water-parting of the continent; then continued forward until he reached a transverse water-parting, which divided the waters of the Columbia and N. Saskatchewan on the one hand from those of the Kutanie and S. Saskatchewan on the other. There he found the facilities for crossing the mountains to be so great as to leave little doubt in his mind of the practicability of connecting the plains of the Saskatchewan with the opposite side of the main chain of the Rocky Mountains, even by means of a railroad.

As regards the scenery of the Rocky Mountains, there is a remarkable absence of peaks. Fine glaciers fill the upper hollows of the range; and from different arms of the same large glacier proceed the N. and S. branches of the Saskatchewan. The snow-line appears to have been between 6000 and 7000 feet above the sea. In lat. $51^{\circ} 40'$, at a height of 6300 feet, snow was lying in patches under the shade of trees, notwithstanding a clear midday sun.

There is very little game about the mountains; the most remarkable animal of those that exist is the white goat. It lives on the highest parts of the range, and seldom descends. As a consequence of the absence of game, Indians are rarely met with, and none of them possess other than very vague knowledge about the passes. The Kutanie Indians are a wretched set, though rich in horses.

The country of the Upper Saskatchewan was found to be far less fertile and well timbered than had been supposed. There are large tracts of worthless soil, and constant prairie fires have utterly destroyed the greater part of the timber—so much so, that the travellers were usually in difficulty owing to the want of firewood.

About Fort Edmonton wheat is raised, and cattle remain out of doors the whole winter. Potatoes grow excellently.

The PRESIDENT.—In returning thanks to Captain Palliser, Dr. Hector, Lieut. Blakiston, Mr. Sullivan, and the other gentlemen employed in this

expedition, and particularly to Sir Edward Bulwer Lytton for his kindness in communicating this despatch to us, we ought to be proud of this important communication, for I venture to say that without the stimulus of the Royal Geographical Society the expedition never would have been undertaken. The object we geographers had at heart was to ascertain whether practicable passes through the Rocky Mountains could be found within the British territory. On the other hand, Her Majesty's Government very wisely determined, as a prelude to such explorations, that Captain Palliser should occupy a large portion of his time in determining the possibility of a commercial route being established between Canada and the important possessions of the Hudson Bay Company, and through the last to our now important colony of British Columbia, and so on to Vancouver Island. The result of the observations of our travellers as to the nature of the easternmost of their explorations, and the relative altitudes of the ground, and the difficulties of the portages, has been already laid before you. As your President, I would rather wish to restrict the discussion to the nature of that great region to the west of Lake Winnipeg, the region, in short, of the affluents of the North and South Saskatchewan rivers, which, we are told, is capable of becoming a great and important colony. Captain Palliser describes this region as being fertile, capable of producing anything, and good crops of grain.

The chief geographical feature to which I would call your attention is the remarkable fact that where the Rocky Mountains rise to their highest altitude, there are to be found the lowest depressions or passes; so that while the Americans in travelling to the central parts of California have to encounter passes at 7000 feet above the sea, Englishmen may on their own ground travel through gorges only 5000 feet above the sea.

Gentlemen, there are several persons present who can give you much information on this subject. For example, I see Mr. Ball, the Under Secretary for the Colonies, who in the late Government was a most active organiser of this expedition. Then we have a gentleman (Mr. Edward Ellice), a distinguished member of the Legislature, who has a large stake in the Hudson Bay Company, which has for so many years governed the region with great benefit to the poor Indians; then we have also Lord Bury, who has recently returned from America, and has earnestly studied this subject, and who is emulating his noble father in his zeal for geographical science. Sir George Back is also present, who is familiar with the eastern waterparting of the Rocky Mountains; whilst I hope that from the discussion which may ensue, the Bishop designate of British Columbia, who has honoured us by his attendance, may gain some useful knowledge preparatory to the important mission on which, thanks to the liberality of one of the noblest and kindest of our countrywomen, he is about to proceed.

MR. JOHN BALL.—I feel that I can say but very little. It happened to be my duty to assist in sending out this expedition, an expedition not due to the Government, but to this Society. I must say that I feel great satisfaction in the intelligence which we have recently received from them. For the first time since nearly forty years they have traversed a district which has borne a very ill name among white men, I mean the country of the Black Foot and Blood Indians. That they have done so in safety is due in some degree to favourable circumstances, but also to the great tact and skill of Mr. Palliser in conciliating their affections. Arrived at the foot of the Rocky Mountains, their expectations have been far more than realised. Not one pass, as they supposed, but three practicable passes have been discovered. Two of them seem to merit, in an especial degree, the attention of the public in this country; because, since that expedition was sent out, great national interests have become involved in the communication with the west coast of America, in consequence of the gold discoveries in that far distant region. The new

southern pass, which was discovered by Mr. Palliser, leads into the valley of the Kutanie river, and carries you down the course of that river into American territory. The two more northerly passes are entirely upon British ground. One of them, the Vermilion Pass, leads to the Kutanie river, near to its source; and a second accessory pass presents itself immediately you have crossed the dividing ridge of the Rocky Mountains. Turning to the right, with scarcely any perceptible elevation, you pass from the head waters of the Kutanie river to a branch of the Columbia river. Northward of that is another pass, a little higher, called the Kicking Horse Pass, of which I have not been able to hear the full details. It remains to be decided which of these two passes—both of them very eligible in point of geographical position—will be the more available for use, subject to the condition that for a great part of the year the mountain range must be covered deep in snow. One word, however, as to the mode of getting to this country. The real difficulty appears to me to be in traversing that small portion which lies between the corner of Lake Superior and Rainy Lake. It does appear, from information I have received from Mr. Palliser, that there is no insurmountable obstacle in carrying a land-road, for a certain distance to the westward, parallel to the course of the White Fish River, which falls into the Kammistaquoia somewhat below the Kakabeka Falls. But then there comes a region of swamps and rocks, so intricate that you never seem to remain long on either land or water; and without some enormous outlay, there seems no practicable mode of making a land-road in the direction which they took. Nor is there any convenient way of travelling by water, except by the tedious one of small canoes and crossing portages, of which 26 were found in the lower course of the White Fish River. Why I allude to this matter is, because the small space of 50 or 60 miles from Pigeon River to the Kammistaquoia, so far as I know, has never yet been explored by white men; and if it should be found that there is a sufficient amount of dry and solid land on which a road can be made, it will throw open to British enterprise, in the valley of the Saskatchewan, a tract of territory of greater extent than the whole of France and England put together. Before sitting down I may allude to one peculiar feature of this country, and that is the extraordinary nature of the watershed in the Rocky Mountains. Except in the Carpathian chain, we have nowhere in the old world anything exactly like it. The rivers seem to pass across the axis of greatest elevation. The two main branches of the Saskatchewan river pass to the westward of the highest mountains in the chain, Mount Murchison and Mount Hooker; and on the western side of the chain we have this extraordinary fact—two rivers flowing parallel to each other a few miles apart for a long distance, the Columbia and the Kutanie, one running to the N.W., and the other to the S.E. It appears to me one of the most singular facts that we know of in physical geography.

LORD BURY, M.P., F.R.G.S.—I shall certainly make it a point to follow in the general direction which you, Sir, have pointed out; but, like the last speaker, I, too, cast rather a longing eye to that corner of the country to which he has alluded. With regard to the present expedition, Captain Palliser has had the advantage, which he shares only with the explorers of some parts of Africa and Australia, of dealing with an almost unknown subject. The reason why we are ignorant of this country is, that it has been to a certain extent shut up by the Hudson Bay Company. That Company holds territorial sway and exclusive right of trade over the whole of the country. The importance of the discovery of these three passes must depend in a great measure upon the value of the land on each side of the Rocky Mountains. If the land to the eastward between Lake Winnipeg and the Rocky Mountains, and the land to the westward near to the new colony of Columbia, be valueless, then the discoveries which Captain Palliser has made will be equally valueless. But if we can

show that on the development of the country which lies between Lake Winnipeg and the Rocky Mountains the future greatness of British North America almost exclusively depends, then we shall be able to realise the full importance of these discoveries. We have in British territory two of the greatest harbours in the world,—on the Atlantic shore the harbour of Halifax in Nova Scotia, and on the Pacific shore that of Esquimault in Vancouver Island. I cannot resist expressing a hope that at no distant day we shall see these two connected; and then it will be that the importance of this discovery will come into play. And now, if you will allow me, one word about this corner of the country which has been alluded to by Mr. Ball. He intimated that in the *hauteur des terres* separating the waters running towards Hudson and James Bay, and the waters running towards Lake Superior, lay the greatest difficulty which had been as yet encountered. I suppose that the gentlemen present know that for the last two years the Canadian Government, as well as the Home Government, has had an exploring party between Lake Superior and the Red River. I have seen the result of their explorations, and I do not think there exists such an insuperable objection to the formation of a land road as he supposes. I have myself been over that height of land, and the greatest obstacle is a swamp called the Savanne. In that swamp, in the space of three-quarters of a mile, there is a fall of thirty-one feet. Except in isolated places, that swamp is nowhere more than three or four feet deep; and at the bottom you get a strong clay. I venture to say, on the authority of greater men than myself, that it is one of the easiest parts to form a road. An American would cut down the brushwood and pile it on the top of the swamp, then cut down a few trees and pile them on the top of the brushwood, and that would form a temporary road; and when a better road was wanted it could easily be made on the top of the substratum thus laid. With respect to the remainder of the country between Lake Superior and Red River, I think no great difficulty exists. I am one of what would in old times be called a company of adventurers who have contracted with the Canadian Government to carry their mails from Canada to the Red River. We do that, with our present small means and inefficient organisation, twice a-month without difficulty. That fact is a sufficient argument to the objection that the Savanne swamp is an insuperable obstacle to road-making. With respect to the value and extent of the cultivable land between Lake Winnipeg and the Rocky Mountains, Mr. Blogget, the distinguished American climatologist, estimates that it contains altogether about 500,000 square miles fully adapted for the operations of agriculture in every way. Assuming that estimate to be correct, about 437,000 square miles, or more than 717 millions of acres, would be in the British territory. Although but a small part of the territory of North America, it would be enough to support all Great Britain and her dependencies. We know that the buffalo can winter on the Upper Athabasca just as easily as they can in Minnesota. We know, too, that on the two branches of the Saskatchewan all the grain grown in temperate latitudes can be easily raised. Just south of the boundary-line the great equestrian tribes of the Indians winter their horses, and it is not to be supposed that that boundary, a mere astronomical line, separates the fertile regions of the United States from a sterile region beyond. Experience has proved that that is not fact. Buffalo and wild cattle can live perfectly well there; and wherever grain is tried it has succeeded almost beyond the hopes of those who have undertaken it. The want of a market has been the great thing which has stopped them.

The noble Lord then entered at some length into the climatology of the territory in question, to show that it was highly favourable for colonisation as far north as Lake Athabasca and Peace River, and even in some places on the Mackenzie River as high as 60° N. latitude.

The PRESIDENT.—I again congratulate the Society upon the value of the

Reports which have been read, and also upon having heard from Lord Bury such an able exposition of the physical capabilities of this great country. I have also great pleasure in announcing that, in reply to an application which I made to obtain permission for Captain Palliser and his associates to return to England by crossing the Rocky Mountains into British Columbia, Sir E. B. Lytton has acceded to that request, which had indeed been preferred by the travellers themselves; and thus many most important and interesting additions will doubtlessly be made to those discoveries the nature of which we have been considering this evening.

Seventh Meeting, February 28th, 1859.

SIR RODERICK I. MURCHISON, PRESIDENT, in the Chair.

PRESENTATIONS.—*Lieut.-General P. Cannon; Viscount Strangford; James Brand, Pascoe St. Leger Grenfell, T. Corbyn Janson, and Thomas Sopwith, C.E., Esqrs., were presented upon their election.*

ELECTIONS.—*Major A. C. Cooke, R.E.; Lord De Blaquiere; Commander W. N. W. Hewett, R.N.; Rev. Evan Lewis, B.A.; Captain Kenneth Murchison; Captain Robert Havard Price; Lieut.-Colonel J. F. D. Crichton Stuart, M.P.; Rev. F. W. Tremlett, M.A.; and Henry Hulse Berens; William Ewart, M.P.; Henry Hansard; William Mitchell; Thomas Phinn, Q.C.; Edward Rawdon Power, and Henry William Willoughby, Esqrs., were elected Fellows.*

AUDITORS.—Thomas H. Brooking and E. Osborne Smith, Esqrs., on the part of the Council, and Thomas Lee, Esq., and the Rev. J. Worthington, D.D., on the part of the Society, were appointed Auditors.

EXHIBITIONS.—Two large paintings by Mr. Atkinson, showing the character of mountain scenery at the source of the Bascan, and the snowy chain of the Ac-tu, were exhibited.

The Papers read were :—

1. *A Journey through some of the Highest Passes in the Ala-tu and Ac-tu Mountains in Chinese Tartary.* By T. W. ATKINSON, Esq., F.R.G.S. and G.S.

DURING my wanderings in Central Asia I came upon several large river-beds, in some of which there was no water, in others the streams were so small that it was difficult to account for the formation of such enormous water-courses. I shall therefore attempt to describe a phenomenon caused by a terrible earthquake at some distant period, which rent the mountains asunder, letting out the water of a large Alpine lake, which has formed one of those vast channels across the plain. I also hope that my description will